

# PATENT COOPERATION TREATY


# PCT

REC'D 01 FEB 2006

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference H100231PC		<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/EP2005/001090		International filing date (day/month/year) 03.02.2005	Priority date (day/month/year) 06.02.2004	
International Patent Classification (IPC) or national classification and IPC B01D53/94				
Applicant HTE AKTIENGESELLSCHAFT				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input checked="" type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  06.09.2005		Date of completion of this report  02.02.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer  Bogaerts, M  Telephone No. +31 70 340-2335		



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2005/001090

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-39 as originally filed

**Claims, Numbers**

1-21 received on 16.11.2005 with letter of 16.11.2005

**Drawings, Sheets**

1/8-8/8 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☒ the claims, Nos. 1,3-21
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	3,4,6-9,11-13,16,17,20,21
	No: Claims	1,2,5,10,14,15,18,19
Inventive step (IS)	Yes: Claims	
	No: Claims	1-21
Industrial applicability (IA)	Yes: Claims	1-21
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item I:**

1. Present claim 1 comprises the additional feature "wherein the majority of zirconium oxide consists of its monoclonic form". The applicant has based the addition mainly on example 2 where it is said that the "majority of the support oxide - based on a very specific zirconium oxide XZ16075 - is composed of the monoclonic form of the zirconium oxide". There is no basis for the generalization of this very specific case to all zirconium oxides.
2. All claims referring back to claim 1 are thus considered as not comprising this added feature.

**Re Item V:**

Reference is made to the following documents:

D1: EP-A-931590

D2: EP-A-1034832

D3: US-A-4299734

D4: US-A-5073532

D5: US-A-6026640

D6: US-A-6021638

D7: US-A-5179059

1. Documents D2 (claim 1 e.g.) and D3 (col. 1, line 60 - col. 5, line 39) disclose a catalyst for exhaust gas purification in diesel/internal combustion engines, comprising iron oxide, platinum and a support oxide containing zirconium oxide.  
D2 also discloses the use of the catalyst for removing pollutants from diesel engines, and a method for removing pollutants from exhaust gas from diesel engines in the constant lean mode.  
The subject-matter of claims 1, 14 and 15 is not novel (Article 33(2) PCT).
2. In present claim 2 the catalyst is defined in terms of the process of its manufacturing. As admitted by the applicant the catalyst could - although "by mere coincidence" - also be manufactured by the processes of D2 and/or D3. The allegation that the

process as claimed would lead to a different catalyst (different properties and different structure) can therefore not be followed. The subject-matter of claim 2 is not novel (Article 33(2) PCT).

It is further submitted that there is nowhere in the application any comparison of the claimed catalyst with the catalyst of D2 and/or D3, so that, even when the applicant could demonstrate the novelty of the catalyst, the catalyst (per se) of claim 2 could not be considered as being inventive.

3. The subject-matter of claim 13 cannot be considered as involving an inventive step (Article 33(3) PCT).  
Because no comparison is made with the catalysts, manufactured according to the methods of document D3, it is not clear which additional technical effect might be achieved by applying the active metal to the support before calcination. It is clear that also in D3 a single calcination step might be possible, see e.g. claims 8-11.  
The alternative production method appears to be merely one of a very limited number of alternatives from which a skilled person would select one according to his needs, without any inventive skill.
4. Dependent claims 3-12, 16-21 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows:  
The additional features either are known from D1 to D7 or are obvious for a skilled person.  
In addition it is submitted that most of the additional technical features appear to not solve any new or additional technical problem.

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PCT/EP2005/001090  
hte Aktiengesellschaft the high  
throughput experimentation company

November 16, 2005  
H100231PC MR/ABB

### Amended Patent Claims

(clean copy)

- 5     1.     Catalyst for exhaust-gas purification in lean-burn engines, characterized in  
that the catalyst comprises at least the following components:
- (i)     iron oxide,
  - (ii)    platinum or rhodium or a mixture of platinum and rhodium  
as active metal,
  - 10     (iii)   zirconium oxide as support oxide,
- wherein the majority of zirconium oxide consists of its monoclinic form.
2.     Catalyst for exhaust-gas purification in lean-burn engines, characterized in  
that the catalyst comprises at least the following components:
- 15     (i)     iron oxide,
  - (ii)    platinum or rhodium or a mixture of platinum and rhodium  
as active metal,
  - (iii)   zirconium oxide as support oxide,
- obtainable by a process comprising the following steps:
- 20     (j)     applying the iron oxide to the support oxide (iii) by contacting the  
support oxide with a salt of iron which is dissolved in a liquid,  
wherein the active metal (ii) is applied to the support oxide prior to  
the iron compound being added, together with the iron compound  
or after the iron compound was added,

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(jj) subsequently decomposing the iron salt by a heat treatment involving an increase in the temperature, wherein the iron compound is converted into iron oxide (i).

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3.. Catalyst according to Claim 1 or 2, characterized in that it comprises a promoter selected from the group consisting of rare earth oxide, gallium oxide or indium oxide or mixtures of these compounds.

10 4. Catalyst according to one of Claims 1 to 3, characterized in that the iron oxide, the active metal and, if present, the promoter are jointly present on the support oxide.

15 5. Catalyst according to one of Claims 1 to 4, characterized in that its X-ray diffractogram does not have any reflections which are characteristic of the iron oxide.

20 6. Catalyst according to one of the preceding claims, characterized in that the mass ratio, based on the metal elements, of the total iron oxide used relative to the total active metal used is in a range from 1 : 1 to 10 : 1.

25 7. Catalyst according to one of the preceding claims, characterized in that the total active metal used forms a proportion of 0.1% by weight to 5% by weight relative to the total support oxide used.

8. Catalyst according to one of the preceding claims, characterized in that the at least one rare earth oxide is selected from the group consisting of La,

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Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu oxide and mixtures or mixed oxides of at least two of the abovementioned oxides.

- 5 9. Catalyst according to one of the preceding claims, characterized in that the mass ratio, based on the metal elements, of the total promoter used relative to the total active metal used is in a range from 1 : 1 to 20 : 1.
- 10 10. Catalyst according to one of the preceding claims, characterized in that it is in the form of a powder, granules, an extrudate, a shaped body or as a coated honeycomb body.
11. Catalyst according to one of the preceding claims, characterized in that it comprises an NO<sub>x</sub> storage component.
- 15 12. Catalyst according to Claim 11, characterized in that the NO<sub>x</sub> storage component is selected from the group consisting of oxides or carbonates of Ba, Sr, La, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, on a porous support oxide.
- 20 13. Process for producing a catalyst according to Claim 1 , characterized in that it comprises bringing the iron oxide (i) or an iron compound from which the said iron oxide is formed as a result of a heat treatment into contact with the active metal (ii) and the support oxide (iii), or process for producing a catalyst according to claim 2, characterized in that it comprises the steps (j) and (jj):
- 25 (j) applying the iron oxide to the support oxide (iii) by contacting the support oxide with a salt of iron which is dissolved in a liquid,



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wherein the active metal (ii) is applied to the support oxide prior to the iron compound being added, together with the iron compound or after the iron compound was added,

- 5 (jj) subsequently decomposing the iron salt by a heat treatment involving an increase in the temperature, wherein the iron compound is converted into iron oxide (i).

- 10 14. Use of a catalyst according to one of Claims 1 to 12 or of a catalyst produced as described in Claim 13 for removing pollutants from exhaust gases from lean-burn engines.

- 15 15. Method for purifying the exhaust gas from lean-burn engines in the rich/lean and/or constant lean mode, characterized in that a catalyst according to one of Claims 1 to 12 or a catalyst produced as described in Claim 13 is used.

- 20 16. Method according to Claim 15, characterized in that the rich/lean mode is realized in alternating rich and lean cycles, with the ratio of the duration of lean cycles to the duration of rich cycles, in normal driving mode, being at least 10 : 1, and the absolute duration of a lean cycle in normal driving mode being from 10 seconds to 180 seconds.

- 25 17. Method according to Claim 15 or 16, characterized in that the exhaust-gas purification comprises the oxidation of hydrocarbons and carbon monoxide and the reduction of nitrogen oxides, and optionally also, in the case of diesel engines, the removal of particulates.

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18. Method according to one of Claims 14 to 16, characterized in that the lean-burn engine is selected from the group consisting of spark-ignition engines with direct petrol injection, hybrid engines, diesel engines, multi-fuel engines, stratified charged engines and spark-ignition engines with unthrottled part-load operation and higher compression or with unthrottled part-load operation or higher compression, each with direct injection.
19. Method according to one of Claims 15 to 18, characterized in that the catalyst is installed in a position close to the engine or in an underfloor position.
20. Method according to one of Claims 15 to 19, characterized in that an NO<sub>x</sub> sensor is used to control the rich/lean cycle, and a richer phase is induced precisely when a predetermined NO<sub>x</sub> limit value is exceeded.
21. Method according to one of Claims 15 to 20, characterized in that the catalyst is used in any desired combination with at least one of the catalysts or filters selected from the following group: starting catalyst, HC-SCR catalyst, NO<sub>x</sub> storage catalyst,  $\lambda$ -controlled three-way catalyst, particulate filter, soot filter.